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Information and  
Communications  
Technology

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A Strategy for Alberta

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# Information and Communications Technology

A Strategy for Alberta



## Credits

This report has been prepared by the Information Technology Task Force of the Alberta Science and Research Authority for Dr. Lorne Taylor, Minister Responsible for Science, Research and Information Technology.

Recommendations and opinions gathered here from the ICT community in Alberta extol broad measures to maximize the contribution of the information and communications technology (ICT) sector to Alberta. The contents of the report reflect the input received through detailed interviews and questionnaires with more than 65 stakeholders from the ICT sector in business and education, and from information and recommendations contained in preceding relevant studies. The report complements and reinforces earlier strategic plans to ensure Alberta's long-term prosperity put forth by Alberta Economic Development, the Alberta Economic Development Authority, and the Alberta Science and Research Authority.

The report is available in three formats:

1. An executive summary.
2. The core report explained in a 14-page discussion paper, plus further elaboration in six appendices (what you are reading).
3. Website access to the executive summary and the core report with appendices.

Input was received from individuals selected specifically for their professional involvement in ICT. Names and affiliations of those interviewed are found in Appendix VI. Areas of application included communications equipment and services, system integration, software development, Internet, multimedia, electronic commerce, education and training, geomatics, energy, agriculture, forestry, medical, military, government information technology, and multinational computer products and services.

An inventory of Alberta's current assets in ICT is listed in Appendix I. A definition and description of ICT is found in Appendix II. What the stakeholders told us is summarized in Appendix III. Four particularly relevant studies and other references are described in Appendix IV. A note on the difficulty of measuring the ICT sector is found in Appendix V.

*A discussion paper from the Alberta Science and Research Authority.*

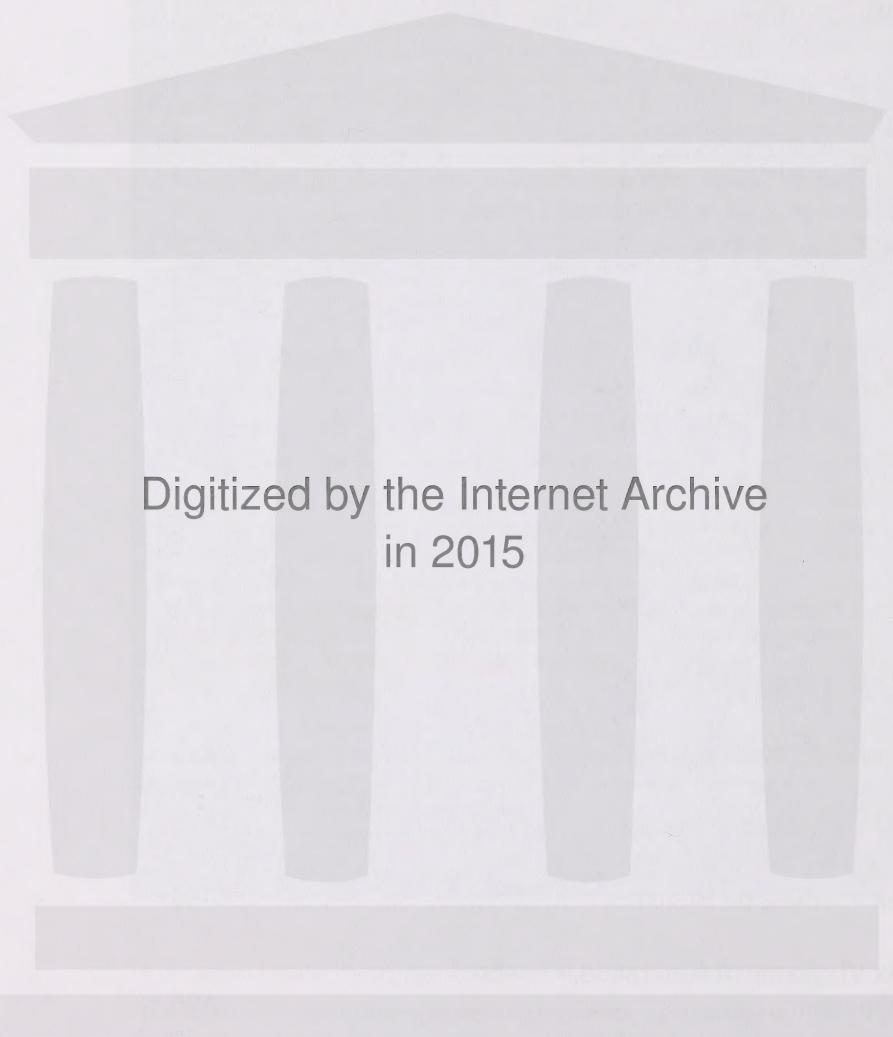
*The Alberta Science and Research Authority was established in 1994 by the Government of Alberta to maximize the effectiveness of science and research as an integral component to the success of the province in the global economy.*

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# Information and Communications Technology

## A Strategy for Alberta

### Perspective

Information and Communications Technology (ICT) is the world's strongest, fastest growing economic sector. An ICT culture expands human skills and improve living conditions; time and distance are no longer barriers. The convergence of applications and content delivery in the computing, telecommunications, publishing, multimedia, and home entertainment sectors is driving significant growth in hardware and software industries. Application development, service delivery, manufacturing, and research and development form the foundations of the ICT sector. The main resources needed to drive this sector are well-educated knowledge-based workers, a society with a culture of use, supporting infrastructure, and well-funded research and development to ensure sustained, long-term growth.

The Industrial Age has given way to the Information Age as technological advancements in computers, telecommunication, software, and digital information provide new economic opportunities. Globalization and deregulation have further accelerated the growth of employment and wealth creation in the ICT sector. With the proper use and encouragement of ICT, Alberta can seize the opportunity to become more productive and more competitive in the global economy.

Several governments have recognized the ICT opportunity and are developing a strategy to capture part of the market. Sharing an aligned vision of ICT and its unlimited future opportunities, Albertans are in an enviable position now to move aggressively and successfully forward into the new millennium.

### Assets and Opportunities

Alberta currently supplies 0.3 to 0.4 percent of world demand for ICT. In 1997, production from Alberta's ICT sector accounted for 11 percent of Canadian output.

**Our Vision: Albertans will enjoy sustainable prosperity and quality of life through science, research, and information technology.**

Informed sources in Alberta estimate at least 1500 enterprises of more than five employees each, annual output in excess of \$8 billion, and 35,000 to 40,000 employees. The majority of Alberta ICT companies have annual revenues up to \$25 million—typically in the \$1 million to \$10 million range. About 100 Alberta ICT enterprises enjoy annual revenues in the \$25 million to \$100 million range. Almost 10 enterprises generate Alberta-based revenues in excess of \$100 million annually, two of which have output exceeding \$1 billion.

The current Alberta ICT sector includes NORTEL Networks, Computing Devices Canada, Raytheon (formerly Hughes Aircraft Canada), Harris Communications Ltd., JRC Canada Inc., and the many suppliers of industrial and commercial instrumentation manufactured in Alberta. On the services side, software and computing services companies include the computer bureaus and systems integrators like IBM/ISM, SHL Systemhouse, and CGI, the seismic data processors, reservoir modellers, multi-media, CAD/CAM services, computer assisted learning, and the more than 1300 Alberta-based suppliers of scientific, financial, and shrink-wrapped software. TELUS, MetroNet Communications Corp., Sprint Canada Inc., Shaw Communications Inc., and ACCESS The Education Station are the major telecommunications and broadcasting companies in the province.

The contribution of ICT to Alberta's economy is not limited to the ICT producing sector. The output and employment numbers indicated above do not include thousands of management information systems and scientific software professionals employed in other sectors. For example, ICT pervades the energy sector. It is the core technology of seismic data processing and interpretation, reservoir management, electronic data interchange, financial control, and general management.

Investing in the ICT sector can help make our vision of Alberta a reality. ICT is about improving the capacity of Albertans to live better.

Albertans, regardless of location, will enjoy access to improved health care without leaving their communities, at lower overall cost to the system. Regardless of income or place of residence, Albertans will have access to superior education and training whenever and wherever wanted. Those committed to lifelong learning will value information access devices connected to the world. With quality health care and education within easy reach, Alberta's rural communities will thrive.

The cost to manage our natural resources will be lower. Alberta's enterprises will compete successfully around the globe. Conducting business globally will be easier, cheaper, and faster for companies large and small.

**ICT can make our vision of Alberta a reality.**

Access to government information will be streamlined and simplified. Government will do business electronically.

With effective use of ICT, Alberta's environment will be cleaner, and the quality of living higher.

These are all possibilities within our grasp.

## The Current Economy

The economy of Alberta remains dependent on the traditional natural resource sectors of energy, agriculture, and forestry. Because natural resources are globally traded commodities with selling prices set by others, an economy based solely on resource products is vulnerable. Consequently, Alberta is too often subject to economic booms and busts. The booms, which strain our infrastructure and drive up costs, are followed by sectoral unemployment and mild recession during busts. Moreover, in the longer term, the natural resource sectors cannot provide the level of economic foundation needed to sustain the quality of life Albertans desire.

**Developing strategies to grow Alberta's ICT industry is now an important priority.**

In September 1997, the Alberta Science and Research Authority (ASRA) released for discussion "Sustaining the Alberta Advantage." This strategic document states that in the 21<sup>st</sup> century the traditional resource-based economy cannot assure high-quality employment for our children and grandchildren. The report champions the importance of "investing in knowledge, our most important renewable resource".

Developing strategies to grow Alberta's ICT industry is now an important priority. Other provincial institutions—notably Alberta Agriculture, Alberta Economic Development, and the Alberta Economic Development Authority—have proposed strategic plans to ensure Alberta's long term prosperity.

Industry Canada through its Connecting Canada initiative has recognized two trends:

1. that the knowledge-based economy (KBE) is driving global growth, and
2. that future growth and prosperity depends increasingly on a KBE focus.

Much good advice is contained in earlier studies, particularly in the four Alberta studies described in more detail in Appendix IV: *Barriers to Technology Commercialization in Alberta* by Bruce Healy, Davitech Consulting Inc; *Alberta's Information Technology & Telecommunications Infrastructure: Building on Our Strengths* by Dr.

Marshall M. Williams; *Report # 1* by Alberta Economic Development Authority Council Technology Task Committee; and *INFORMATION, the Key to Our Future*, report of the INFOPORT Facilitation Group to Opinion Leaders.

Of the many industrial sectors that Alberta might target for diversification, ICT products and services is the most attractive. Supply is limited only by our imagination. Prices are determined by the inherent usefulness of the content to the consumer. These properties are under the control of the supplier. ICT products and services have high added value and can be sold globally, helping to dampen demand swings in the local economy.

The ICT industry is the world's strongest, fastest growing economic sector. In 1997, the output of ICT products and services in the United

**Alberta can—and must—participate fully in this global opportunity.**

States surpassed that of manufacturing to become the largest economic sector. Globally, annual revenues exceed US\$2 trillion, growing at rates over 9 percent annually, and employing more than 10 million workers worldwide. Alberta is in a position to gain more market share than it has today.

Over the past five years, output from Alberta's ICT sector has grown 10 to 12 percent annually, due to globalization, deregulation and increased competition among communications suppliers, explosive use of the Internet, and the rapid growth in international sales from the ICT manufacturing sector. Informed trade sources place Alberta's 1997 output at roughly 11 percent of Canadian gross output. Annual R&D expenditures are in the order of \$210 million.

As indicated earlier, these numbers do not include the thousands of management information systems and scientific software professionals employed by Alberta companies using ICT, such as oil and gas exploration and production, and financial companies.

Alberta can participate fully in this global opportunity, and must. Alberta has the assets to become a world-class centre of excellence for ICT. With appropriate leadership and commitment, by 2010, Alberta will command 0.5 percent of the global market for ICT products and services. By 2010, the Alberta ICT sector will employ 140,000 Albertans; ensure a ubiquitous, affordable, high-speed communications infrastructure; attract more than \$1.5 billion annually in R&D investment; and generate annual revenues of \$30 billion in Alberta.

## Maximizing Opportunities

The strategy proposed here to advance the Alberta ICT sector recognizes the potential we already have and makes recommendations

to achieve our goal by 2010. Sixty-five interviews and questionnaires from Alberta stakeholders in the ICT sector provided abundant data. The question asked of the stakeholders was “What actions should Alberta take to achieve our vision?” Responses have been consolidated into four key areas of emphasis unique to Alberta’s current reality:

- **investment in education,**
- **development of the ICT infrastructure,**
- **growth in investment in R&D, and**
- **growth in ICT business.**

At the same time, the stakeholders recognize that growth and development will thrive in a particular kind of setting. We begin with the recognition that any jurisdiction seeking to develop and recruit advanced technology businesses must provide

- an attractive quality of living,
- a well developed physical, telecommunications, and business infrastructure, and
- a competitive economic environment.

In light of our assets, Alberta is in a good position to move forward. Consistent with our recommendations, successful examples of a “Technopolis” display certain characteristics across the globe. There is agreement that every flourishing instance of an integrated ICT culture can provide evidence of the following factors:

- People and education—A large pool of highly skilled knowledge-workers, supported by regional technical colleges and universities.
- Industrial base—An established base of technology-intensive enterprises with at least six major international technology-intensive companies.
- Research and development—An established base of industrial and government R&D activity supported by a research-intensive university.

Furthermore, these priorities thrive in a favourable setting—what we know as the Alberta Advantage:

- Transformational Leadership—Leadership by government, industry, and education that demonstrates to its citizens and to the world that the entire community is committed to building a successful “Technopolis”.
- Information Society Culture—An entrepreneurial, knowledge-intensive society characterized by a high degree of networking and interaction among individuals.

**The Task Force's four key priorities—investment in education, development of the ICT infrastructure, growth in investment in R&D, and growth in ICT business—conform with these successful factors.**

Our recommendations for a successful provincial strategy are described in this discussion paper.

## Invest in Education

**Recommendation: Double—at a minimum—the output of ICT-skilled knowledge-workers through post-secondary education in the province. Doubling our output of graduates in computer, communications, mathematics, physics, and engineering fields, retraining others, and recruiting a comparable number from outside makes our goal of 140,000 knowledge-workers attainable by 2010.**

Alberta's technical institutes, colleges, and universities are central to a knowledge-intensive society. These institutions are the primary on-going source of highly skilled knowledge-workers. When deciding where in the world to invest, technology-intensive companies consider post-secondary institutions as a key determinant. Such institutions are lead agencies in creating a culture of entrepreneurship and use of information.

Alberta's post-secondary institutions today graduate some 2,000 ICT-skilled knowledge-workers annually. Continuing education is offered to a further 8,000. Private sector institutes are an increasingly important source of training to upgrade earlier ICT skills or to enhance education in complementary fields.

In the ICT sector, highly skilled people are the natural resource. Such talented people have an enormous effect on growth and employment. Thus, the importance of universities in attracting outstanding scholars and graduate students can not be overstated. The essential contribution of Stanford University to the growth of Silicon Valley is the students that it attracted who, upon graduation, elected to make their careers in the region.

Through the use of the Internet, students now can access courses from the world's best universities. As a consequence, an individual can acquire a quality education, without attending an accredited institution. This ability to learn—while on the job or at home—is one important way to develop the 100,000 additional knowledge-workers Alberta will require by 2010.

Alberta's 26 universities and colleges are changing their ICT practices. They recognize the increasing importance of continued collaboration with each other and with industry. Advanced Education and Career Development is focussing on enhancing ICT emphasis by providing funding for the expansion of degree and related programs.

**Recommendation: Increase awareness of ICT career options to develop a culture of knowledge-workers in Alberta. Encourage more kindergarten to grade twelve students to consider careers in ICT. Promote opportunities for retraining the current Alberta workforce. Recruit skilled workers from outside the province.**

We need to make all Albertans aware of the contributions that ICT can make to their quality of life and career. Raising awareness of options at elementary and secondary schools fosters excitement, opportunities, and the importance of the ICT sector. Alberta Education's new ICT curriculum for kindergarten to grade 12, mandated for introduction in September 2000, is an important contribution to promoting interest in the ICT sector from an early age.

Within the current Alberta workforce, trade and professional associations can encourage entrepreneurship and promote increased linkages and networking among individuals who develop and use ICT products and services.

The Software Human Resources Council estimates that as many as 12,000 new job opportunities for skilled software workers are open in Canada. The availability of individuals with strong technological capabilities, whose key business function is to create and manage information, is by far the most significant incentive to grow the ICT sector in Alberta.

The stakeholders estimate as many as 2,000 ICT-related jobs are currently available in Alberta. Major players like IBM and NORTEL Networks state that their Alberta-based operations would expand with the availability of qualified computer programmers or wireless technology engineers. More than 50 percent of Alberta companies report challenges in hiring and retaining qualified personnel. Opportunities for highly qualified workers abound in Alberta.

## **Develop the ICT Infrastructure**

**Recommendation: Ensure an open, fair, and competitive communications environment that supports and protects all types of information exchange.**

Future economic advantage will come from a vigorous ICT infrastructure that provides access to information, supports electronic commerce, and provides access to services in lifelong learning, health, recreation, and business. Our goal is to connect 90 percent of Albertans within three years—providing high-speed access to 100 percent of schools, 95 percent of businesses, and 80 percent of residences.

The stakeholders share the belief that given the freedom to compete, the private sector will provide appropriate high-performance broadband service throughout Alberta. The ICT sector is being driven by continued growth in capacity and complexity of semiconductors

and communications networks. Add to this growth the need for customized information and the demand for a high performance communications network to deliver that information.

Convergence of these technologies has resulted in increased competition among the telephony, cable, and computing companies. The result is vastly improved service at lower cost to the consumer. The only appropriate government action is to develop a footprint of what exists and what is needed, and focus on removing the barriers to full provision.

**Recommendation: Ensure that government programs, information services, and information systems are effective, electronically accessible, and make efficient use of shared infrastructure. In this way, the government demonstrates its endorsement of and commitment to a culture of ICT use.**

New developments, investment, and jobs will move to regions that offer affordable access to high performance, two-way, broadband service with connections to the world. Fortunately, Alberta's telecommunications infrastructure is already among the best in North America, particularly in the major communities. With this networking capacity, Alberta can compete with the best in the world.

Rural regions deserve the same service at competitive rates. Once installed, two-way broadband capacity makes possible applications like telemedicine that could provide all Albertans with more accessible health care services in a cost effective manner. The implications for telecommuting and tele-education continue to develop and open opportunities for locations once considered isolated.

## **Grow Investment in R&D**

**Recommendation: Create an environment that is globally competitive through world-class research and development in the ICT sector.**

R&D is the key component to sustain long term growth in all sectors and to guarantee Alberta's strategic advantage in ICT. Technology most often is commercialized for the first time in close proximity to where the research and development leading to the technology was performed.

Nowhere is this more obvious than in Ottawa, Canada's leading high technology centre. The transformation of Ottawa from government town to Silicon Valley North can be traced directly to the decision to locate Bell-Northern Research (BNR) in Kanata during the 1950s. Many of Canada's largest advanced technology companies, like Corel, Mitel, and Newbridge, can trace their origins to former BNR or NORTEL Networks employees.

When the government acts to champion excellence in research and development and endorse university–business alliances, the ICT research capabilities in our universities benefit both university and industry. The quality of the scholarly research underway at Alberta's universities is of great importance in attracting high quality graduate students to the challenge of forefront research, and the opportunities for technology commercialization.

Industry, university, and government collaboration attracts outstanding researchers, trains graduate students, and develops the technology needed to support and drive a broad range of leading edge initiatives. Proposed areas of activity include:

- high performance networks;
- advanced simulation and visualization software;
- data, information, and knowledge repository, storage, access, and synthesis;
- social, human, and cognitive science;
- computer-supported collaborative work;
- data and network security;
- software engineering; and
- entrepreneurial business networking in the ICT sector.

There is good reason to believe that a world class centre supporting applied research in computer science, software, and information technology would attract support from major international companies. Much of Alberta's current prosperity can be traced to investments made by government and industry in R&D over the past 15 years. Prior investments by Alberta in centres of excellence to assist technology-intensive small- and medium-sized enterprises and in pre-competitive research initiatives have been handsomely rewarded by improved industrial competitiveness and growth. Examples of earlier investments<sup>1</sup> include:

- electronic circuit design
- electronic and environmental testing for Alberta's emerging microelectronic sector
- an applied telecommunications research consortium based on industry, university, and government collaboration
- research and development in enabling the technology of advanced industrial materials

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<sup>1</sup> These projects are elaborated on in Appendix I, in explanations of AMC, TEC, TRLabs, WESTAIM, and WurcNet.

## The Austin Miracle—Silicon Hills

The remarkable success of the Austin Miracle is attributed to the leadership of one concerned individual. Austin, the nerve centre of central Texas technology, is fast becoming an international high technology and software development hotbed. In the mid-1980s, high-tech visionaries made the conscious decision to move beyond the first wave of major semiconductor and computer manufacturing operations that had located in the region a decade earlier. Dr. George Kozmetsky, the father of Austin high technology, fostered a "Technopolis effect" whereby business, government and academia came together for the common goal of transforming Austin into a high-tech Mecca. A concerted effort by business and political forces to bring high-tech to Austin succeeded in winning the hotly contested Microelectronics Computing Corporation, a technology consortium, as well as Sematech, a chip maker research consortium, affording Austin prestige and significant building blocks.

Yet, at about the same time, the Austin economy began to implode—the victim of an overbuilt real estate market and deep Texas recession. Unemployment increased markedly and real wages dropped. Groping for an answer to the economic devastation, the timetable toward Austin's becoming a technopolis was accelerated. Corporate recruiting visits to Silicon Valley took place touting inexpensive housing; skilled, cost effective labour; and an outstanding quality of life. An umbrella of collaborative organizations, both public and private, also

## ➤ high-speed network research and development.

An economic environment that enhances the speed at which products are brought to market can be a powerful incentive to choose Alberta for investment in development and trials. Because of the short competitive life span of products and services, often measured in months, successful commercialization of ICT is critically dependent on bringing products to market quickly. Delay can reduce the useful market life of the product and hence reduce the income needed to recover the prior investment in research and development.

When compared to annual ICT revenues, ICT R&D in Alberta is currently 2.5% of revenues—or about \$210 million. The goal for 2010 is to double that percentage to 5% of revenues—approximately \$1.5 billion. R&D is key to sustaining long term growth and guaranteeing Alberta's strategic advantage in ICT. With a competitive environment, Alberta can spark innovation. Successful knowledge-intensive companies depend on it. Investment in research, development, and manufacturing is attracted by it.

## Grow ICT Business

**Recommendation: Continue to facilitate commercialization in Alberta to grow ICT business beyond the 1500 or more ICT companies that exist in the province today. Encourage ICT industry to continue its rapid investment in Alberta, to grow existing facilities, and to attract new business.**

To grow Alberta ICT output to \$30 billion by 2010, from its current level of \$8 billion, requires an annual growth rate of 12 percent. In North America, more than 85 percent of economic growth usually comes from within the community, with the remaining 15 percent from newly recruited companies.

International companies—like Computing Devices Canada, Harris Communications Ltd., Raytheon, NORTEL Networks, Pratt and Whitney, TELUS, MetroNet Communications Corp., and Shaw Communications Inc.—create valuable markets for local suppliers, both locally and abroad. Through their procurement, international companies cause local suppliers to introduce and maintain world class standards, which equips and qualifies them to sell into global markets. Large international companies also bring challenging job opportunities for Albertans. Often they recruit workers with particular skills, some of whom will spin off to launch local ventures.

When recruiting investment from outside, Alberta must focus on attracting innovative, knowledge-intensive activities like research, development, design, marketing, and management.

The Team Alberta initiative to recruit a world-scale semi-conductor fabrication facility to Alberta is a praiseworthy effort. This initiative

unites in a collaborative effort the resources of Alberta Economic Development, Alberta Microelectronic Centre, Alberta Research Council, Calgary Research and Development Authority, Economic Development Edmonton, and the private sector.

The introduction and use of innovative applications of information technology within government and municipalities, universities, schools and hospitals (the MUSH sector) can be a powerful engine to develop or attract local enterprises. Nationally, the four largest computer technology companies—SHL Systemhouse, CGI Inc., DMR, and LGS—were launched with government contracts: three from the Quebec government, one by the federal government. Today, these four companies represent more than \$5 billion in annual revenues and boast more than 30,000 employees.

Examples of companies attracted by government procurement to invest in Alberta include then-Northern Telecom (originally investing in Alberta to supply the needs of Alberta Government Telephones), Computing Devices Canada, and Raytheon. They came in response to federal procurement criteria that favoured Western Canada-based suppliers. These three companies— together with their Alberta-based suppliers—employ some 8,000 Albertans and bring considerable wealth to Alberta. Most of their sales come from outside Canada.

The Alberta government's annual procurement of ICT totals \$400 million annually: \$170 million directly by the provincial government and the balance from the MUSH sector. These funds, which will be spent in any event, can be used to encourage the growth of Alberta's ICT sector.

The office of Alberta's Chief Information Officer recognizes the potential to stimulate the ICT sector and has established policies to identify and standardize the information technology needs of government, co-ordinate procurement, and communicate the needs to the private sector in a timely manner. The CIO is creating more flexible contractual terms and conditions. These will enable faster approvals and sharing of intellectual property on development projects.

One way in which Alberta has demonstrated leadership in the past—and can continue to lead in the future—is by launching and supporting major initiatives that benefit society. At the same time, these initiatives drive the development and application of technology. Such initiatives can help build Alberta's ICT sector by recruiting and retaining outstanding companies and individuals. See Appendix III for a list of cutting edge projects cited by the stakeholders.

emerged to help mobilize the effort, including the University of Texas at Austin, the Austin Technology Incubator, the Austin Software Council, the Software Quality Institute, and the Technology Advisors Group. The end result was a steady in-migration of high-tech companies and personnel. Clearly, a miracle has occurred. Firing on all cylinders, the Austin metropolitan statistical area ranks seventh nation-wide in population growth (with an increase of 23.1 percent from 1990 to mid-1996), overall unemployment stands at 3.2 percent, per capita income increased by 59 percent between 1987 and 1995—outdistancing all other Texas regions.

What differentiates Austin from other technology markets? Affordable, high quality living, high calibre programmers and software engineers, and the fact that Austin is not so much an end-user market, as is the case with Dallas and Houston, but an application-development centre. Jim Rapp, TechWeb

## Enhancing the Alberta Advantage

### Transformational Leadership

Alberta can compete globally. We have a solid base in ICT, a strategy for economic diversification, and an entrepreneurial culture suited to change. With transformational leadership, Alberta can capitalize on growth in the ICT sector for the next several decades. As the world enters the information age, today's Alberta strategy and strategic investments lays the foundation for Alberta's prosperity, excellent quality of life, and sustenance of the Alberta Advantage.

To reach its full potential, Alberta's ICT sector requires the same vision and commitment as was given to oil and gas, agriculture–food, and forestry sectors earlier this century. Leadership is among the most cost-effective ways in which government can stimulate investment and growth. The stakeholders unanimously recommend the government be proactive in making Albertans and the world aware of our shared commitment to becoming a knowledge-intensive society, and of the consequent benefits that will flow to Albertans and to companies that invest in Alberta.

Leadership is needed to articulate to the citizens of Alberta, particularly young people, the opportunities for career advancement and personal development. Government leadership is essential to create a competitive economic climate and to provide Alberta's schools, colleges, and universities with the resources to graduate greater numbers of skilled knowledge-workers. Government and industry leadership is necessary to support key initiatives demonstrating that Alberta truly is committed to this vision.

Leadership inspires commitment to a shared vision and collaboration among companies and between industry and government.

### The Information Society Culture

As Premier Ralph Klein has noted in "People and Prosperity: a human resource strategy for Alberta:"

We are living in an age of information and technology, in which new economic opportunities are increasingly based on the application of knowledge<sup>1</sup>

In a dynamic global economy, the only way Alberta can sustain its high quality of living is by becoming a knowledge-intensive society, one that uses information and communications technology to a competitive advantage. This is our foundation. We will remain

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<sup>1</sup> [http://www.aecd.gov.ab.ca/ministry\\_info/people/#vision](http://www.aecd.gov.ab.ca/ministry_info/people/#vision)

competitive and continue to make the most effective use of our resources. Albertans recognize the contributions that ICT can make to their quality of life and career.

Culture is the ultimate competitive advantage that differentiates Alberta from other jurisdictions. Albertans are hard working, highly productive, outward looking, technology accepting, and entrepreneurial. These cultural characteristics coupled with Alberta's attractive economic environment and availability of highly skilled workers are a winning combination in attracting investment. This culture needs continued encouragement at all levels from kindergarten through to grade 12, colleges, universities, government, and industry.

## Monitoring Progress

This report involved an extensive study of the ICT market within Alberta. It has attempted to identify our progress to date and launch the province into a strategy that will evolve as the technology expands. In order to maintain our resilience as a province thriving in the ICT sector, annual reviews should correct our focus and keep us responsive to change. Continuous growth requires flexibility in our programs and sensitivity to life in a dynamic environment. We recommend that our progress be measured annually, taking stock of industrial output, employment, R&D investment, and net recruitment of skilled knowledge-workers.

## Conclusion

The success of these recommendations will be measured by our society's progress toward achieving the priorities of investment in people, infrastructure, and an enabling environment. These are most likely to be achieved through shared responsibility between government, industry, and education. The Task Force hopes that this report will contribute to a better understanding of the importance of ICT to Albertans and inspire the leadership that will move Alberta to the position of North America's most knowledge-intensive society.

## Recommendations for an ICT Strategy for Alberta

### Invest in Education

- Double the output of ICT graduates; retrain and recruit others.
- Increase awareness of ICT career possibilities.

### **Develop the ICT Infrastructure**

- Ensure an open, fair, and competitive communications environment.
- Demonstrate government commitment to a pervasive ICT culture of use.

### **Grow Investment in R&D**

- Create a globally competitive environment through world-class ICT R&D.

### **Grow ICT Business**

- Facilitate commercialization in Alberta to grow ICT business.

## Appendix I Assets and Opportunities

In order to reach our overall goal producing 0.5 percent of the world's output of ICT products and services, Alberta needs to take stock of our assets and identify our opportunities, as these will determine what specific actions are most appropriate. Appropriate initiatives already underway need to be encouraged and strengthened.

Alberta has substantial assets to achieve our goal as demonstrated by the fact that Alberta already supplies 0.3 to 0.4 percent of world demand for ICT. 1997 production from Alberta's ICT sector exceeded \$8 billion, accounting for 11 percent of Canadian output. The ICT producing sector employs approximately 35,000 to 40,000 Albertans. Alberta does not have a good assessment of the number of ICT companies operating in the province. Informed sources estimate at least 1500 enterprises of more than five employees each.

The contribution of ICT to Alberta's economy is not limited to the ICT producing sector. Information and communications technology is employed by all sectors of society and the economy. The output and employment numbers shown above do not include the thousands of management information systems and scientific software professionals employed by Alberta companies using ICT.

### Intellectual and Educational Base

#### Highly educated workforce

Alberta enjoys a strong intellectual and educational foundation. Alberta is Canada's most highly educated province, home to a large pool of highly skilled knowledge-workers. Students enrolled in Alberta's public schools routinely rank among the best in North America. Alberta's universities, technical institutes, colleges, and private sector schools annually graduate about 2,000 computer science and electrical engineering knowledge-workers. Another 8,000 individuals take extension courses to refresh and upgrade their skills. Several hundred more are enrolled in private sector schools offering advanced ICT courses. Calgary is Canada's most highly educated major city: 58 percent of adults have at least some post-secondary education.

#### Universities and colleges

Alberta's research-intensive universities rank among the very best in Canada, annually conducting more than \$170 million of externally-funded research. Scholarly university research attracts outstanding graduate students and creates the technology that spawns new ventures and attracts investment. The Northern Alberta and Southern Alberta Institutes of Technology are among Canada's leading technical colleges. Grant MacEwan and Mount Royal Colleges enjoy national reputations. Alberta's universities and colleges are used by many regional companies as test beds for the development and application of new technology.

#### The Banff Centre for the Arts

The Banff Centre hosts world-class workshops and courses in new media and attracts new media artists in multimedia, animation, and interactive entertainment from around the world.

## Communications Infrastructure

Alberta has one of the best telecommunications and home video communications systems in North America. Significant developers of this infrastructure include:

- TELUS, Alberta's largest ICT company, supplying telephone and Internet service throughout Alberta, with \$4.3 billion in assets, 9,300 employees and annual revenues in excess of \$2 billion.
- Shaw Communications Inc., a diversified Canadian communications company whose core business is providing cable television services to approximately 1.5 million households. Shaw is Canada's second largest video cable company, with assets of \$2.5 billion and revenues of \$700 million. Shaw also has interests in radio broadcasting, direct-to-home satellite television, paging, and Internet services.
- MetroNet, a recent entrant, provides fibre-optic high speed, broadband data and voice transmission in the central cores of Calgary and Edmonton (and other major Canadian cities), and has broadband fibre-optic links to British Columbia and the USA.

In addition to the private sector networks, Alberta Public Works Supply and Services has had the foresight to evolve a province-wide network, called AGNPAC, that covers over 90 percent of Alberta. This network provides a high performance, secure and reliable backbone for the network services of many government users. There is a strategic opportunity to expand this network to an extensive group who would benefit from a low cost, state-of-the-art network infrastructure. Participants could include, but would not be limited to, municipalities, universities, schools, and hospitals. The network would automatically enable information gathering and sharing, distance learning and global access to the Internet, and provide the infrastructure for health applications such as telemedicine.

## Established Industrial Base

Seven areas of established strength and great potential for growth are elaborated here.

### Wireless Communications

Alberta is the wireless technology centre of Canada, with the potential to become the leading centre in North America. A cluster of wireless technology and telecommunications equipment manufacturing companies has emerged in the Calgary region. In part, this is a result of the NovAtel investment in cellular telephone development during the 1980s and, in part, because of the research excellence of TRLabs Wireless Laboratories. Major players include:

- Northern Telecom with two manufacturing plants and 2,700 employees—Calgary is Nortel's world centre for wireless technology.
- Computing Devices Canada, a systems integrator and manufacturer of radios for Canada's military, with 750 employees.
- Harris Communications Ltd., manufacturer of cellular telephone equipment, with 300 employees.

- JRC Canada Inc, Lethbridge, a manufacturer of traditional cellular phone products, global positioning systems, vehicle location devices, mobile and satellite communications equipment, with 150 employees.
- A group of smaller companies employing wireless communications technology for industrial instrumentation and telecommunications products. Typical are B&W Technology, Cell-Loc, NovAtel, and Wi-Lan.

This cluster, together with their Alberta-based suppliers and sub-contractors, generates sales in excess of \$3 billion and employs some 4,500 Albertans. Annual research expenditures exceed \$125 million.

### System Integration and Scientific Software

A large number of systems integration and scientific software companies, have been launched to serve the needs of Alberta's energy sector, but typically supply much wider applications into markets throughout the world.

- Major local players include Merak Projects Ltd., Qbyte Services Ltd., DKW Systems, Munro Gerhardt division of Haliburton, Montage IT Services, and Minerva Technology Inc.
- The principal multinational players are CGI, DMR, IBM/ISM, SAP, and SHL Systemhouse.

Clusters of companies in both Calgary and Edmonton provide system integration and support services to governments, the natural resource sectors, transportation, manufacturing, and general business.

### Multimedia

A burgeoning multimedia sector characterized by more than 300 small companies has located in Calgary and Edmonton. The University of Alberta and The Banff Centre for the Arts provide leading edge, world-class research support. The Edmonton New Media association has been formed to serve and promote the industry. Edmonton has become a recognized centre for quality work in the field of new media and this reputation enables local firms to be an attractive choice for worldwide companies looking for high-end production.

### Geographic Information Systems and Global Positioning Systems (GIS/GPS)

A world competitive cluster of geographic information systems and global positioning systems technology companies includes Nortec Surveys, Pelorus Navigation Systems, QC Data, Tecskor Software Inc. The Department of Geomatics at the University of Calgary supports this sector.

### Supervisory Control and Data Acquisition (SCADA)

Many of Canada's SCADA systems companies are based in Alberta. Most originally were launched to satisfy the needs of pipeline, oil, gas, and petrochemical processing companies.

- Major players include Bow Software Inc., GE Harris Energy Systems, Hewlett Packard, MegaSys Computer Technology Ltd., Sandwell International Inc. and Valmet Automation (Canada) Ltd.

### Data Processing, Modelling, and Visualization

Alberta's initial ICT sector—seismic data processing and reservoir modelling—has developed to revenues of some \$400 million, more than half from off-shore, and 4,000 employees.

- Major companies include Computer Modelling Group Ltd., Applied Terravision Systems Inc., Hyptech Ltd., and Raytheon.

### Entertainment, Publishing, Broadcasting, and Film

As the ICT sector moves towards the convergence of information and communications technologies, the entertainment, publishing, broadcasting, and film industries become more closely tied to the sector. Alberta has a developing computer games industry and an established and active film and television production industry.

## Private—Public Partnerships

### Alberta Research Council

Alberta Research Council is the largest applied research institution in Alberta with some 450 technical and support staff. With an annual budget of \$46 million, more than half of which is earned from contract services, ARC is an enabler, a leader in the transfer and application of technology to natural resource exploitation and in application of information technology and advanced manufacturing technology to support Alberta companies.

The Alberta Research Council has a group of computer scientists and engineers who work on many joint research ventures and development projects with industry. The group, located in Calgary and established in 1985, has a track record of over 100 applied research and development projects that have resulted in many new software products and business spin-offs.

One example is the Electronic Test Centre (ETC), launched in the early 1980s by Alberta Research Council to provide electronic and environmental testing for Alberta's emerging microelectronic sector. The ETC contributed to the rapid growth of Alberta's industrial instrumentation sector. The ETC has been privatized and now provides services throughout western Canada and into the USA.

### TRLabs

Founded in 1986, TRLabs is an applied research consortium based on industry, university, and government collaboration. Active partners now number close to 40, representing significant growth from the original three. With an annual revenue of nearly \$10 million, TRLabs is the largest not-for-profit telecommunications research consortium in Canada. It operates a network of research laboratories in Calgary, Edmonton, Regina, Saskatoon, and Winnipeg, and has plans for future operations in British Columbia. Over 180 highly motivated and skilled individuals work at TRLabs, consisting of staff researchers, professionals seconded from industry, professors, graduate and undergraduate students, and technical and administrative support staff. Its research program is focused

on five strategic areas: networks and systems research, photonics, wireless communications, networks access, and data networking and related software.

### WurcNet

WurcNet is a not-for-profit, Alberta-based consortium of researchers, government agencies, educational institutions, and corporate partners supporting high-speed network research and development in Alberta. WurcNet's key application areas are health, education, telecommunications, earth resources, and business. WurcNet manages Wnet II, the next generation of the Internet in Alberta, and associated projects that connect research computers across Alberta to Canada's Next Generation Internet and CANARIE's CA\*net II. The next generation of Internet will require significantly more two-way bandwidth to the home, business, and mobile platforms.

### Technology Enterprise Centres

Both Calgary, through the Calgary Research and Development Authority, and Edmonton, through Economic Development Edmonton, support small business incubators. These centres provide business support and mentoring, shared office services, access to technology, funding, partnerships, and markets at affordable rates.

### Other Examples

Alberta Microelectronics Corporation (AMC) for electronic circuit design has been newly privatized. AMC provides turnkey design and manufacture of embedded systems and markets proprietary thin-film and micro-machining technology throughout the world.

WESTAIM was launched in 1990 as a joint industry-government collaboration to create a capacity in Alberta for research and development in enabling the technology of advanced industrial materials. Today, WESTAIM is a private Alberta company with 400 employees in Alberta, listed on the TSE 300 with a market capitalization of \$675 million.

### Community Initiatives

Several Alberta communities are committed to full participation in the knowledge-intensive society.

#### INFOPORT—Calgary

In 1988, the City of Calgary, with the support of 150 leaders from the business community, developed a long-range strategic plan for economic development, called "Calgary into the 21<sup>st</sup> Century". One of the identified goals was that Calgary should become an INFOPORT that is, a world-leading centre for development and production of information technology products and services for sale into global markets. Responsibility for implementing the vision of INFOPORT was assigned to the Calgary Research and Development Authority which, with financial assistance from TELUS Corp., has been working to develop local ICT companies and recruit major investment from outside Alberta. On an individual project basis, INFOPORT builds linkages among companies, universities, and colleges to develop promising business opportunities. Through seminars and taskforces, INFOPORT addresses important issues affecting the ICT sector including, for example, the growing shortage of knowledge-workers.

## SMARTCITY—Edmonton

Edmonton City Council has developed a vision for Edmonton as both an international SMARTCITY with a vibrant economy where businesses want to locate and expand, and as a culturally diverse city where people choose to live, learn, work, and play. SMARTCITY activities focus on developing strong links among Edmonton's growing highly skilled workforce, major research institutions, vibrant culture, and high technology industries.

InfoCity Festival, Edmonton's largest SMARTCITY initiative, annually showcases innovation and excellence in the application of information and communication technologies that impact the way citizens in the Edmonton region live, learn, work, and play.

## CyberCity Initiative—Grande Prairie

Founded in 1996, the CyberCity Initiative aims to help Grande Prairie citizens learn about and prepare to participate and compete in the Information Revolution sweeping the developed world. The initiative has three principal thrusts:

- Co-operative deployment of shared high-speed equipment, systems and software providing universal interactive access to data and information.
- Generation of awareness throughout every segment of the community concerning the opportunities and challenges of living and competing in the Information Age.
- Assurance of affordable, managed, inter-operable equipment and network connections that are reliable, expandable, and secure.

An informal Task Force, chaired by the City Manager, is determining how best to implement the Grande Prairie CyberCity Initiative.

## The Continuous Learning Community—St. Albert

The City of St. Albert is the site for a grassroots volunteer initiative to establish St. Albert as a “world-class, learner-centred, continuous learning community.” The quest, inspired in November 1995, is driven by recognition of significant, deep-seated changes elevating the value of continuous learning at all levels throughout society.

A Steering Committee, chaired by the mayor, and consisting of a dozen volunteers and partners—KPMG, TELUS, ACCESS, VICOM, and Athabasca University—facilitates the activity of four working groups and over 250 volunteers developing an array of community-based initiatives.

- Public Participation—elevating people's appreciation of the value of learning.
- Partnering—strengthening inter-organizational relationships to facilitate corporate learning.
- Prosperity—attracting and growing commercial learning systems to St. Albert.
- Planet—establishing regional and global relationships for the exchange of learning.

A Continuous Learning Celebration Society manages the assets and liabilities of the volunteer initiatives and is owner of the Learning Passports and Credits Card.

### The New Media Initiatives

Edmonton: The New Media community in Edmonton is large and vibrant. In 1996, several Edmonton organizations took the initiative to create an association to serve and promote the industry. The association has become an influential focal point of the multimedia community. A website has been established so members can access unique and useful services. The impact of new media applications and the speed of public acceptance steadily increase. Edmonton has become a recognized centre for quality work. This reputation enables local firms to be an attractive choice world-wide for companies looking for high-end production.

Calgary: In 1998, a similar group in Calgary established the Alberta New Media Association to serve southern Alberta.

### Provincial Initiatives

#### Office of the Chief Information Officer (CIO)

In 1995, the Alberta Science and Research Authority released a report authored by Dr. Marshall Williams entitled “Alberta’s Information Technology and Telecommunications Infrastructure: Building on our Strengths”. The report recommended the Government take quick action to become a model user of technology, to address regulatory and policy issues, and to take a leadership position to grow the industry.

The report was instrumental in encouraging Premier Klein to create the Office of the Chief Information Officer that same year. The Office of the CIO has moved quickly to address many of the recommendations outlined in the Williams Report:

- Created a Council of CIOs, creating the post in each Ministry of Government to enhance the co-operation and co-ordination of information resource management activities within government.
- Made the Office of the CIO responsible for all policy matters relating to the information highway. The Office placed on the national agenda many policy and regulatory issues as they relate to the ICT industry regulation, privacy protection, electronic commerce, and access to government information.
- Developed a government-wide information resource management strategy to address information and technology management issues raised by ICT within government.
- Led the initiative to ensure all government computers and applications are ready for year 2000.

The progress made by the Office of the CIO in addressing government use of technology and its ability to speak to policy and regulatory issues allows for an additional focus to the government’s approach to ICT.

## Opportunities

The opportunities for the development of new ICT products and services are enormous. “In the 21<sup>st</sup> century, information technology industries will drive economic wealth. The innovations developed by the computing, telecommunications, consumer electronics, and electronic media industries will affect every business, large and small – and dramatically change our home lives as well”<sup>1</sup>. Following are some of the key social, economic and technological trends that will have major effects on developments in ICT.

**Life Long Learning**—In order to remain competitive, globalization necessitates continuous upgrading of education and training throughout a working lifetime. The availability of learner centred instruction, with superior content and presentation, offered inexpensively over the web—any time, any place—promises to transform the way Albertans learn and, consequently, to metamorphose Alberta’s universities, colleges, schools, and businesses.

**Health Care**—Health care is by far the world’s largest service business. Alberta alone spends \$4 billion annually on health care; Canada over \$60 billion. Acquisition and use of information is at the heart of health care delivery and management. The Alberta WellNet is the first step in developing an integrated patient information system for Albertans. Under Alberta’s new health care system, where consumers are expected to assume greater responsibility for their health, people can be educated at home about their medical condition and how best to deal with it.

**Electronic Commerce**—Electronic commerce over the Internet is growing explosively. The world of ATMs and bankcards is extending into the home and business, and requires many new commercial applications. Customer orders, purchasing, receiving, inventory management, accounting, design, engineering, analysis, manufacturing, negotiating, and shopping will become more integrated and available from everyone’s desktop. International Dataquest Corporation forecasts that commerce over the Internet in the United States will reach \$220 billion by 2001, while Industry Canada forecasts that world-wide electronic commerce will amount to US\$2.5 trillion by 2000. Within Alberta, data transmission over the Internet gateway is increasing 350 percent every 12 months.

**Computer-Supported Collaborative Work**—The globalization of business, the growing prospect of telecommuting, the complexity of information, and the variety of skills required to be an effective team or organization is creating ever-greater demands for software and communications technology. Distributed individuals want to meld into effective teams. Developments in computer hardware, databases, and increased bandwidth can support distributed visualization, simulation, and real-time interaction.

**Multimedia Content**—Multimedia entertainment is driving graphics technology and visualization to the benefit of far-removed applications like seismic analysis. The current youth and the next generation of Albertans will expect multimedia content for all of their information, whether for entertainment, education, or business. World-leading development and application of technology in the arts and entertainment is occurring at The Banff Centre for the Arts.

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<sup>1</sup> Price Waterhouse Technology Forecast 1997

## Appendix II What is ICT?

Information and Communications Technology (ICT) is a tool to expand human skills and make living better. Time and distance are removed as commercial barriers. With the proper use of ICT, Albertans can become more competitive. Consider the following scenario, developed for us by two children—and only slightly futuristic—and identify some of the ways ICT impacts your daily life.

John (10) and Sarah (8) present “A technological day in the life”

You, your husband Don, and twin daughters, live about an hour southeast of Calgary on an acreage. You are the county physician with a well-established family practice of some 5,000 patients, and an office located in the local rural farming town. Don, a geologist, is employed by one of Alberta's midsize oil and gas exploration companies, in charge of field operations in Yemen and Dubai. Daughters Laura and Chelsea have just turned 13 and attend the regional junior high.

It's Monday at 6:10 a.m. The alarm on your wireless personal digital assistant (PDA) has just gone off. You glance over and get your good morning message, morning funnies, current temperature and weather forecast, and the security status of your home and car. The aroma of coffee and fresh bread drifts up from the kitchen. Both the coffee maker and bread maker were programmed, through your personal agent software, to be ready for breakfast.

Each of you has a wireless networked PDA: Don is quickly reviewing his agenda, and Laura is checking the bus arrival time and her class schedule. Chelsea is frantically searching the house for her misplaced PDA. She's worried, since information vital to her class project is contained within the device. Don reassures her that the information—with all other family data—is accessible through the network from a mainframe host in southern Alberta.

Laura turns on the TV to search the Internet for information for her class project on Zimbabwe. Finding what she needs, she quickly downloads it into her PDA, ready to be integrated later that day into her assignment. She'll review this new information on the bus ride to school.

Don, who dabbles in the Chicago futures market, checks his PDA for the opening prices for Canada as well as the status of some of the well heads he is responsible for. A few notes on his PDA confirm that some of the previous day's transactions have been completed.

During breakfast, your PDA alerts you that the county hospital requires your attention. Julie, one of your expectant mothers, is about to deliver. At one touch of the PDA's stylus, you advance your day's schedule by half an hour. This advance triggers a series of actions: the garage door automatically opens and your car starts, but also your PDA links you online to the hospital for a text message on Julie's current status. En route to the hospital, through a series of voice commands, your wireless phone connects you directly to the hospital and simultaneously downloads data into your PDA. You now have enough information at your fingertips to understand Julie's condition when you arrive at her bedside.

Meanwhile, Don heads out to his car—which also started a few minutes prior to his departure—and drives off to a morning meeting in an unfamiliar location. Using his GPS location software, his PDA quickly maps out the shortest route and an estimated time of arrival.

The hospital has certainly become a secure and efficient environment through the help of technology. A quick retinal scan lets you into the hospital, but is also a critical identification device for your patients and allows you access to your networked health records. In the delivery room, a

quick ultrasound is ordered and progress is monitored, not only by you but also by a group of six students from the Calgary Foothills Hospital who are observing today's procedure through videoconference. All is progressing well and the baby should be delivered in about 30 minutes.

Suddenly your PDA alerts you that the emergency ward requires you immediately. An elderly gentleman from High Level, who is visiting his daughter, has collapsed over breakfast. The paramedics have already provided a retinal scan and this patient's medical records are accessible to you as he is being transported to hospital. Through a quick review of his High Level file and information being electronically transmitted by the paramedics en route, you speculate that he has had a stroke. Feeling less confident of this diagnosis, you immediately engage a specialist from the Edmonton University Hospitals who is standing by on the two-way broadband Alberta telemedicine network. On the patient's arrival, you collaboratively develop a diagnosis and immediately commence treatment without having to move the patient, avoiding a life-threatening delay.

In the meantime, Laura checked the GPS on her PDA to locate the bus and Chelsea's PDA. The bus is about three minutes from home and Chelsea left her PDA at her swimming lesson. Laura sends a text message to the lifeguard, asking her to retrieve Chelsea's PDA from her locker and hold it for her.

After his first meeting of the day, Don heads to his office. Using his hands-free cellular phone and his personal agent software, he is directed through a series of voice mails, e-mails, and other voice information such as stock quotes. He also remembers to make an appointment for his snowboarding lesson. Having access to his instructor's calendar, Don can make an appointment when he knows both he and the instructor are available.

Preoccupied by the many activities facing him this morning, Don finds his car alerting him that he has exceeded the speed limit for the past two minutes and that failure to comply with the speed limit will automatically send a fine through the network. Glancing at his wristwatch, Don arrives at the office in good time and rides up the elevator. Using a spoken password and voice recognition system, Don gains access to his office. He reviews a series of monitors displaying a full range of seismic data currently being transmitted from the field team. Don joins his team in a discussion of a series of mathematical models in collaboration with one of their U.S. offices, all connected through a high-speed network.

While one of his American colleagues complains about that morning's traffic, Don sits back, smiles, and realizes how well organized his life is; how he very much enjoys the rural environment yet never feels a lack of access to information or services. He's looking forward to snowboarding later that day, and hearing over supper how the day went for his wife, and her patients, as well as for Laura and Chelsea.

ICT has transformed society and will continue to do so for many decades to come. The engine driving this ongoing revolution is the microprocessor, the sliver of silicon that has led to countless inventions, such as portable computers and fax machines, and has added intelligence to modern automobiles and wristwatches. (Today's automobile contains more computing power than the spacecraft that went to the moon and back. A Timex digital wristwatch contains more computing power than all of Canada did in 1956.) Modern science is inextricably bound to information processing. Scientific advances have enabled the storage, retrieval, and processing of ever-greater amounts of information, helping to generate insights needed for further advances.

Astonishingly, the performance of microprocessors has improved 25,000 times since their invention only 27 years ago. This exponential growth is often referred to as "Moore's Law," named after Gordon E. Moore, co-founder of Intel, who observed in 1965 that the most cost-effective integrated circuits had doubled in complexity each year from 1959 and predicted that this growth in complexity would

continue indefinitely. Since the late 1970s, the pace has slowed to a doubling in complexity every 18 months, leading to commercial integrated circuits today with more than six million transistors. Parallel to this exponential growth is the growth in data storage on semiconductor microchips and other storage media. Throughout this period, the cost of individual chips has decreased so significantly that the cost of an electronic memory circuit has gone from \$10 in the 1950s down to a hundred-thousandth of a cent. Growth in complexity is expected to continue at this pace for the next 7 to 12 years. Intel and its peers now spend about US\$20 billion a year on research to sustain this growth in complexity and power. (*Scientific American*, December, 1997)

A similar growth in complexity is occurring in the capacity to transmit digital data and voice over copper wire, fibre, and wireless systems. Convergence of transmission and computer technologies, coupled with deregulation, is moving ICT forward by stimulating innovation, creating more and better applications, and lowering the costs of the hardware, access to the communications system, and the cost of the content passing through the network.

The result of this explosion in complexity and power is a faster pace of business. Business is becoming more global and more competitive. Networks like the Internet encourage and enable the proliferation of global comparison-shopping, niche markets, and real time transaction processing.

ICT products and services differ from natural resource products in several key ways. The “natural resource” of the knowledge-intensive sectors is highly qualified knowledge-workers, a highly mobile resource that can migrate anywhere in the world. Skilled knowledge-workers are well educated, and motivated by opportunities to collaborate with peers in challenging developments employing the latest cutting edge technology. It was these factors in the 1970s that brought the original cadre of geologists, geophysicists, computer science, and electrical engineers to Alberta to work in the oil patch on applications of information technology—seismic exploration and reservoir management. Much of today’s prosperity in the oil and gas sector can be traced to their contributions. Once here, Alberta’s enviable quality of living and favourable personal tax regime persuaded them to remain. From this pool of highly skilled individuals have come many entrepreneurs who have launched Alberta’s more than 1,500 indigenous advanced technology companies.

Consider, for example, the wireless communications technology cluster that is emerging in Calgary. By 1980, NOVA Gas Transmission was operating the world’s largest radio-telephone network. The network linked its many pumping stations and operations, with Alberta Government Telephones working cooperatively to enhance the capacity and usefulness of the network. These two Alberta companies, both of which had been established as expressions of Alberta’s commitment to strategic development, were among the first to recognize the great commercial potential of wireless telephony. Together they formed a joint venture, NovAtel Communications Inc., to design, manufacture and market cellular telephones. NovAtel’s early technical success, and the presence in Calgary of the substantial pool of wireless technology experts that NovAtel recruited in the early 1980s, encouraged companies like Nortel, Computing Devices Company, Harris, and JRC, to locate their wireless communications activities in Alberta. Today, Alberta’s wireless communications companies—together with their suppliers and subcontractors—employ more than 4,000 Albertans in highly paid interesting jobs.

Large numbers of relatively small companies characterize the ICT sector, even though the global technological giants, like Microsoft, Nortel, Motorola, and Siemens, are among the world’s largest companies. Yet the cost to enter the software and services portion of the market is typically low. One or two software programmers can launch a business from their home with a few thousand dollars for equipment and marketing. The rates of growth of individual companies often exceed 25 percent per

annum, occasionally resulting in some phenomenal success stories. Typically, more than 90 percent of revenues come from export markets.

The economic life of ICT products is measured in months before a new or improved model becomes available. Nortel, for example, produces a new customized version of their Meridian Norstar telephone every one and one-half days. Anyone involved in the Internet can witness the introduction of new applications, such as web browsers, every four to six months. The typical advanced technology company spends in excess of 10 percent of revenues on R&D to remain competitive.

## Appendix III What the Stakeholders Said

The question posed to the stakeholders was “What actions should Alberta take to achieve our vision?” A summary of their advice, ordered by frequency of response, follows. Note how most recommendations are interconnected. Taken together, they form the basis for a comprehensive strategy that will propel Alberta to the forefront of the global economy.

### Demonstrate leadership

Many stakeholders praised the leadership demonstrated by the former Premier of New Brunswick in formulating a strategy to attract call centres, and then in personally leading the successful efforts. Others pointed to the success of the President of Malaysia in attracting private sector investment to Malaysia’s “Multimedia Corridor”. In the United States, Vice-President Gore is an eloquent spokesperson for ICT.

Every stakeholder spoke passionately of the need for the Premier, supported by a senior minister, to articulate the benefits ICT can bring to the future prosperity of Albertans, and the need for Alberta to establish the credibility of its vision by committing to key initiatives. One important leadership role is to support local companies by having the Premier or senior Minister available on short notice to meet with business visitors from outside Alberta, thereby demonstrating the province’s commitment to growing the ICT sector.

The stakeholders believe that it is appropriate for government to encourage development of the ICT sector. At the same time, they caution that support be directed to developing markets, centres of excellence, and infrastructure, rather than investment in specific companies. A common problem faced by many small- and medium-sized Alberta ICT-based enterprises is that of inadequate understanding of competitive forces in centres like Silicon Valley. Better information would assist in the forming of strategic alliances, or in avoiding commitment to projects where others with greater resources are much further advanced.

### Adopt effective strategies to develop, recruit, and retain highly qualified knowledge-workers

Every stakeholder talked of the shortage of knowledge-workers and of the need for Alberta to increase its capacity to develop more knowledge-workers. The stakeholders estimate as many as 2,000 computer-related jobs are unfilled in Alberta today. Major Alberta players like Nortel and IBM state that growth of their operations is constrained by the lack of qualified workers, or that they would add to their investment in Alberta if more qualified computer programmers and RF (radio frequency) engineers were available. Smaller companies report difficulty in hiring and retaining qualified personnel.

The shortage of highly qualified workers is not confined to Alberta and it is not temporary. The Software Human Resource Council estimates that as many as 12,000 positions for skilled software workers are going unfilled in Canada. British Columbia estimates 1,500 positions are unfilled. Ottawa claims 2,000 additional knowledge-workers are required today, while Nortel has announced plans to

hire 4,000 additional workers for its Ottawa operations. Just to retain 3 percent of world markets, Canada will need 1,400,000 ICT workers in 2005.

Each year Alberta loses outstanding individuals to American companies offering higher overall remuneration, typically a package of salary and equity. Alberta based companies have difficulty in matching remuneration paid in the United States because of higher Canadian capital gains tax. Alberta companies can match salaries, but not equity. At the margin, capital gains tax in Alberta runs about 34 percent; American capital gains tax is less than 10 percent.

The stakeholders urge Alberta to adopt a co-ordinated plan that will double the availability of highly skilled knowledge-workers. The most commonly proposed actions were:

- Double or triple the capacity of Alberta's universities and colleges to meet the demand for qualified knowledge-workers, particularly for computer programmers and RF engineers.
- Establish an Alberta Capital Gains Tax Credit applicable to return on early stage investments in ICT-intensive ventures.
- Launch major cutting edge initiatives that are good for business and good for government and that will attract and retain outstanding individuals. Examples of possible cutting edge initiatives include:
  - Alberta wellnet, a joint investment by Alberta Health and the stakeholders in the health care sector designed to develop and implement a health information network across Alberta.
  - Telemedicine—establish a province-wide network of health care providers with a communications infrastructure capable of supporting remote diagnosis by specialists to patients anywhere in Alberta. Implementation demands a systems integrator with the knowledge and central physical infrastructure to provide health care deliverers and users with fully integrated connectivity infrastructure and services, such as emergency access to specialists, together with support services and training in use of the system.
  - “Alberta Intranet,” a fee-for-service network internal to Alberta with gateways to the Internet, providing quality content. Fee-for-service would allow the people who develop, provide, and deliver quality content to be rewarded for their contributions. Alberta Intranet could provide a marvellous demonstration of “how to make money from the Internet.”

### **Focus on applications where the fundamental drivers create the most opportunities**

The historical domain of ICT is “calculating”—applications where the microchip measures things using large mainframe computers, e.g. GPS, seismic, industrial instrumentation, finance and accounting. A few giant successful international companies like IBM, Siemens, and Reuters, whose operations in Alberta are limited almost exclusively to the Alberta market, dominate this domain. The stakeholders believe it may prove difficult to persuade international companies to make significant investments in research, development, and manufacturing in Alberta without significant inducements.

The most exciting growth opportunities for Alberta-based companies are in the domain of electronic collaboration and data sharing, linking the minds of creative people using high bandwidth networks and leading-edge collaborative software tools. Applications such as this are a high growth area, based upon enhancing the ability to create wealth from information and interaction, rather than from hardware or commodities.

The “key enablers” driving the growth of ICT applications most frequently cited by the stakeholders are:

- The growth in complex, persuasive and powerful digital communications networks. The world of networks is shifting from networking of computers to the networking of minds. With growth in power and complexity comes the ability to economically exploit the powers of multimedia applications. Examples include:
  - Integrated community networks linking, for example, hundreds of schools and libraries, each with many rooms and offices. Alberta examples include the Alberta Public Library Electronic Network (APLEN) linking 250 libraries at 300 sites throughout Alberta.
  - Public service networks that make it possible for health care providers to monitor and assess patients in remote areas and the elderly in their homes.
- The increasing demand by individuals for customized information, coupled with the technological capability to deliver customized information anywhere, anytime, on a one-on-one basis via low cost, broadband service.
- The ever-increasing ubiquitous use of integrated semiconductor microchips, in appliances, tools, and games, that makes possible applications based on local area networks, at home, at work or at play. Imagine standing in the local grocery store and contacting by voice-activated cell phone a microchip in your refrigerator to determine whether you need milk. The ubiquitous use of microchips is shaping the nature of our culture and society. Can we take control and use this process to strengthen our culture?

### Make Alberta the haven for innovative activities in Canada

Industry Canada's initiative, “Connecting Canadians,” recognizes that high-performance, broadband communications is key to competitiveness in the global knowledge-based economy of the 21st century. The federal Speech from the Throne, September 23, 1997, states: “We will make the information and knowledge infrastructure accessible to all Canadians by the year 2000, thereby making Canada the most connected nation in the world”.

The stakeholders have read and endorse the recommendations of “Sustaining the Alberta Advantage.” This document sets out a long term strategic plan to make Alberta the preferred location in Canada for innovative activities by “investing in knowledge, our most important renewable resource”. The stakeholders emphasize the importance of the following:

- The need for appropriate tax programs to encourage investment in industrial research and development. Almost every stakeholder complained of Alberta's uncompetitive tax treatment of R&D expense as compared to other Canadian provinces.

- The need for greater systemic capacity to bring products to market in a timely manner. Alberta is deficient primarily due to a lack of electronic prototyping facilities that produce the initial units required for beta testing, and because of the low levels of strategic investment available to launch ICT start-ups and support their marketing efforts. Because of the short competitive life span of products and services—often measured in months—successful ICT commercialization is critically dependent on bringing products to market quickly. Delay can reduce the useful market life of the product and hence reduce the income needed to recover the prior investment in research and development. An economic environment that enhances the speed in which products are brought to market is a powerful incentive to choose Alberta for investment in development and trials.
- Use government procurement advantageously to build Alberta's ICT sector, not just meet immediate needs. Stakeholders frequently observed that four of Canada's largest computer technology companies, CGI Inc., DMR, LGS, and SHL Systemhouse, together representing more than \$5 billion in annual revenues and more than 30,000 employees, were launched with government contracts—three from the Quebec government, one from the federal government.
- Reinforce Alberta's leadership in the ICT industry by gathering and publishing more current industry statistics. To ensure our progress in meeting our vision, Alberta must co-operate with Industry Canada and Statistics Canada to report detailed Alberta-specific statistics about the ICT industry on a regular basis.
- Alberta's colleges and universities are central to our efforts to become a knowledge-intensive society. These institutions are the primary source of highly skilled knowledge-workers. They are the lead agencies in creating a culture of information and entrepreneurship. Scholarly university research attracts outstanding graduate students and creates the technology that spawns new ventures and attracts investment. Finally, Alberta's universities, colleges and associated institutions are seen as test beds for the development and application of new technology. WurcNet and The Banff Centre for the Arts were frequently cited examples.

Many stakeholders noted that ICT is transforming the way in which individuals learn, and the necessity for lifelong learning. High quality instruction in virtually every discipline is now available any time, anywhere, over the Internet, or through electronic media. As a consequence, an individual can acquire a quality education, without attending an accredited institution. The stakeholders acknowledge, at the same time, the supplementary need for real time interaction with an instructor, preferably face to face, one on one. This ability to learn, while on the job or at home, is one important way to develop the 100,000 additional knowledge-workers Alberta will require by 2010. Therefore many stakeholders believe that universities and colleges increasingly will be expected to accept for degree and certification individuals whose education has not been received on campus. If they do not, other certification agencies will take on that role.

## Invest in cutting edge projects that drive technology and that are beneficial for industry and society in general

Examples of initiatives already underway in Alberta, or proposed, include:

\* Alberta wellnet, including the Telehealth Project

Alberta wellnet is an Alberta initiative putting in place new information systems to provide timely, accurate, secure information on health, linking health providers, hospitals, clinics, health organizations, and Alberta Health. The Telehealth Project will make expertise and diagnostic tools accessible to all rural communities and remote sites in Alberta.

\* Advanced Internet/Intranet in Alberta: Expansion and Enhancement

Alberta has been involved in many leading-edge initiatives since the beginning of the Internet. This may be expanded to include future versions of the Internet and use of an Intranet for many government services. At the community level, Calgary, Edmonton, Grande Prairie, Leduc, and St. Albert are exploiting the potential of the Internet to become "CyberCities" and "SmartCities". At the provincial level, the office of the CIO has ensured a state-of-the-art Internet and Intranet infrastructure for all Alberta government departments.

\* Multimedia Advanced Computational Infrastructure Project

A world-leading environment to simulate and visualize complex environments over distance is being constructed between the Universities of Alberta and Calgary, involving high-end computation environments and a high-speed high-bandwidth network.

\* The Institute for Effective Teams

Increasingly, collaboration is the mantra of business and government. Organizations are becoming more distributed in operation. Operations are becoming more focussed, more specialized. At the same time, increasing complexity demands a broader range of skills. The result is the need to unite individuals from many locations into teams that work together effectively, without being physically present in the same location. Examples include

- corporate engineering teams engaged in a design project;
- multi-location, distributed manufacturing;
- effective, distributed board room meetings;
- arm's-length partners developing a strategic alliance;
- two physicians consulting on remote diagnosis;
- students and their instructor engaged in distance learning; and
- telecommuting.

Such an Institute for Effective Teams would spawn and support a broad range of companies with a common focus. The potential for wealth and job creation lie in developing hardware and software for more effective meetings, equipment and service providers of high performance telecommunications and video, more effective telemedicine at lower cost,

concurrent engineering, improved distance education, improved management of natural resource exploitation, and lower cost, higher reliability manufacturing.

\* Research Institute for Multimedia Systems (RIMS)

Recently opened at the University of Alberta the objective of the Research Institute for Multimedia Systems (RIMS) is to conduct state-of-the-art research and development in the area of multimedia information systems. The scope of research covers both the enabling technologies and multimedia applications. The results of RIMS research will contribute to the establishment of Alberta as an international centre for the growing multimedia industry.

\* Learning Commons

Recently opened at the University of Calgary the Learning Commons is a facility to bring together faculty, staff, and students to develop new approaches to learning and to keep educators and students in step with changes in knowledge and technology. The Learning Commons brings together four existing University Centres in an environment conducive to experimentation and collaboration. The centres are Advanced Media for Learning, the Learning Enhancement and Professional Development Centre, Distance and Distributed Learning, and the Undergraduate Curriculum Redesign Centre.

\* Advanced Learning Technology Alliance

ICT is transforming the way individuals learn. High-quality instruction will be available any time, anywhere, over the Internet, or through electronic media. An informal consortium of concerned educators and individuals have proposed establishing the Advanced Learning Technologies Alliance to enhance significantly the use of ICT-intensive content and distance delivery within the primary, secondary, and post-secondary educational systems. The Alliance would oversee funding to encourage and support the development of ICT-based instruction.

A learner-centred education system that relies heavily on technology will improve student performance, increase the technology literacy level of Albertans, and enable Albertans of all ages to use information and technology more effectively in their personal and professional lives. An important benefit will be the growth of local content producers, resulting in creation of jobs and wealth.

Note the common thread of pulling people together that runs through these examples.

Well conceived, innovative, society-shaping projects can benefit individual Albertans, reduce the collective cost of government, and provide wealth-creating opportunities for the private sector. The classic society-shaping project was the American commitment to send an astronaut to the moon in the 1970s. When asked “What society-shaping projects would capture the imagination of Albertans and propel Alberta to the forefront of the global economy?” stakeholders proposed the following.

- Commit Alberta to preserving the world’s highest quality of living. Through the appropriate use of ICT, it is no longer necessary to work and live in one of the major communities. Many of the social and environmental assets that Albertans value, and which provide the highest quality of living in Canada, lie outside the major communities in the rural areas and mountain parks. Appropriate use of ICT can reduce commuting time, preserve the environment, and provide an enviable quality of living. Investment will be attracted from many less favoured regions of the world. Telecommuting using computer-

supported collaborative work tools is just around the corner. Two-way, high performance broadband networks can deliver high quality medical care and education to the smallest rural community.

- Commit Alberta to becoming the world's leading learning society thereby creating a more skilled, competitive society while providing a local market for ICT-based content which can be marketed globally
- Commit the Alberta government to becoming the world's most effective public service. A public service skilled in effective information resource management will effectively employ ICT and the local ICT industry in program and service delivery to Albertans.

### **Recruit additional multinational ICT companies to invest in Alberta**

International companies create markets for local suppliers, both locally and at their other operations. Their procurement demands force local suppliers to introduce and maintain world class standards, which equips and qualifies our local suppliers to sell into global markets. Large international companies like Nortel, Pratt and Whitney, Computing Devices Company, Harris, and Raytheon bring challenging job opportunities for Albertans. Often they recruit workers with particular skills, some of whom will spin off to launch local ventures.

### **Establish one or more internationally-recognized Centres of Excellence in the field of ICT to develop technology and attract outstanding individuals**

Better still, establish distributed Networks of Excellence that leverage the collective capability distributed among Alberta's universities and centres of excellence. TRLabs was held up by many as a model for recruiting and developing outstanding postgraduates. Stakeholders suggested several centres of excellence including:

- Interactive visualization, where the technology is driven by the entertainment sector, but then can be applied to seismic and reservoir modelling, virtual engineering and architecture, communications, video conferencing, and computer assisted collaborative work.
- A convergence centre combining the elements of communications research, digital media research, and content creation. Such a centre would drive high-end graphics, animation, and high performance networks, all areas of great potential value to Alberta companies.
- Voice recognition, a technology in which Microsoft is investing heavily. Coupled with wireless technology and the ubiquitous use of microchips in appliances and tools, voice recognition will find many applications in personal networks and tele-presence.
- Mathematics, the basic underpinning of computer science.
- Marketing of technology, located within the faculties of management of the two major Alberta universities, specifically to assist SMEs in international markets.

### **Strengthen business networking in the ICT sector**

Vibrant networking among workers in the ICT sector is the essential activity that stimulates the creation of new products, strategic alliances, and new ventures, and is the distinguishing characteristic of successful world Technopoles like Silicon Valley and Austin, Texas. Several stakeholders spoke of the potential benefits of an Alberta Technology Executives Network through which CEOs could share problems of common interest. Others proposed encouraging meeting places where employees in the ICT sector would meet informally after work on a regular basis.

## Appendix IV Relevant Studies

The Task Force found the following studies to be particularly relevant in developing recommendations.

**Barriers to Technology Commercialization in Alberta.** Bruce Healy, Davitech Consulting Inc., July 15, 1996. Identifies financing and management as the two most critical barriers facing successful technology commercialization in Alberta today. The report makes five critical recommendations:

- Introduce provincial R&D tax credit
- Establish capital gains offset tax credit
- Allow operation of labour sponsored venture capital company in Alberta
- Facilitate program to recruit and educate “angels” and match with SMEs
- Facilitate program to provide mentoring and networking opportunities to SMEs.

**Alberta’s Information Technology & Telecommunications Infrastructure: Building on Our Strengths.** Dr. Marshall M. Williams, March 16, 1995. “Despite Alberta’s good head start in developing a leading “info-structure”—broadly defined as our total capabilities in the information technology and communications sector—a lack of leadership, co-operation, and accountability has created an environment that is weakening the infrastructure of the province. Action must be taken now to ensure that Alberta can control its future prosperity and not have important assets, like its information and its ability to process and communicate information, removed from domestic influence.”

The report goes on to state “Alberta’s economic development plan, “Seizing Opportunity,” places strong emphasis on the strategic nature of information technology and communications to wealth creation. This industry creates opportunities for and is critical to the success of all other industries and services while, at the same time, is an important industry in its own right. There is strong consensus that while Alberta possesses many strengths, many serious weaknesses must be addressed soon to avoid the province falling further behind other jurisdictions in these areas. Consequently, the government must become more aware of the needs of the information technology and telecommunications industry and develop a strategy to make it a key contributor to the Alberta economy.”

Dr. Williams concludes “action is urgently needed at this time” and recommends three goals:

- 1) “Create a culture of use, by developing useful applications, and addressing the numerous regulatory and policy issues.
- 2) “Ensure the necessary tools are available by providing more high-speed telecommunications links, more training and education opportunities, and encourage the development of new information products and services.

- 3) “Create the opportunity to add value by encouraging the co-operation and partnership between government, Alberta’s information technology industry, business, and academia”.

**Report # 1. Alberta Economic Development Authority Council Technology Task Committee**, February 1995. Identifies five major obstacles that inhibit industry development in the technology sector. These obstacles, together with recommendations to overcome them, follow.

- An apparent shortage of highly skilled managers, scientists, and engineers who can successfully manage technology development and commercialization.  
RECOMMENDATION: Increase by 20 percent annually the number of individuals in Alberta with the skills to successfully commercialize technology.
- A shortage of funding for technology development and application.  
RECOMMENDATION: Double the amount of risk capital available within Alberta for research, development, prototype manufacture and commercialization by
  - immediately changing regulations to level the playing field with Ontario with regard to the provincial tax treatment of R&D expenditures.
  - immediately changing regulations to level the playing field with Ontario, Quebec, and British Columbia with regard to the tax treatment of personal investments in labour capital pools.
  - persuading the federal government to flow research tax credits through to investors.
- Technology that has been developed in Alberta with Alberta funding being sold for short-term gain for others to exploit. RECOMMENDATION: Adopt policies and programs that will encourage the development and commercialization of technology within Alberta.
- In a competitive market, all other things being equal, success will go to the organization which best uses knowledge. RECOMMENDATION: Adopt programs and policies that will enhance a culture that enables Alberta to compete effectively in the 21st century. Specifically, eliminate capital gains tax for investments in Alberta enterprises held for more than 5 years.
- Develop and articulate a focussed vision that all Albertans, including the Premier, will embrace. RECOMMENDATION: Immediately establish a task force of industry and government leaders to develop and articulate, over the next 12 to 18 months, a specific vision for economic development for Alberta—a vision all Albertans can embrace.

**INFORMATION, the Key to Our Future.** Report of the INFOPORT Facilitation Group to Opinion Leaders, October 1992. “Describes an initiative of industry and government leaders, to help create a competitive and dynamic economy for Alberta. This is to be done by transforming Alberta into a society that actively creates and uses information and information technology as well as and better than all others. The vision that we bring is that Alberta has the opportunity to establish itself as one of the dominant regions in the world in the development, application and commercialization of technology.” The report goes on to say, “The establishment of Alberta as an information economy will require the concerted efforts and supports of all groups, with no time to lose”.

**Alberta's Manufacturing Industry Highlights** (sequel to *Manufacturing in Alberta*). Coopers & Lybrand and Alberta Economic Development, June 1998.

**BC High Technology Report.** British Columbia Technologies Industries Association, April 1998.

**"Brain Drain: the brain drain of skilled workers and specialists to the U.S. has suddenly become a major national challenge."** Andrew Purvis, *Time Magazine*, 11 May 1998.

**Budget 1998: The Canadian Opportunities Strategy.** Department of Finance Canada, February 1998.

**Canadian Venture Capital Association Website** at <<http://www.cvca.ca/>>

**High Tech Labour Survey: Attracting and Retaining High-Tech Workers.** KPMG/CATA Alliance, June 1998.

**Information and Communication Technology Workforce Workshop Report.** Charles Reichert, INFOPORT, Calgary Research and Development Authority, March 1998.

**Information and Communications Technology Statistical Review 1990-1996.** 1997/1998 Edition, Industry Canada, April 1998.

**Initial Public Offerings by the Canadian Information and Communications Technology Sector.** Industry Canada, June 1997.

**Manufacturing in Alberta.** Coopers & Lybrand, 1996.

**Preparing Canada for A Digital World: Final Report of The Information Highway Advisory Council.** Industry Canada, September 1997.

**A Profile of Canada's Software Products Industry.** Industry Canada, February 1998.

**"A Sector for All Seasons".** *The Financial Post*, March 1998.

**Selected Content Industries Statistical Review 1989/90, 1994/95, 1996/97.** Industry Canada, April 1998.

**Technology Forecast: 1997.** Price Waterhouse, January 1997.



## Appendix V Notes on Statistics

ICT is a rapidly growing and evolving industry sector. There are currently no industry standards for measuring the activity and growth in the sector, as the current classification schemes do not represent the industry. For example, there is no classification code for Internet Service Providers. Over the period from 1997 to 2000, Statistics Canada will replace the current 1980 Standard Industrial Classification (SIC) with NAICS Canada. The new classification will contain many sectors that did not exist in the SIC structure and that are relevant to the ICT Sector.

This report uses the Industry Canada definition of the ICT sector, in the belief that it is the current best available definition. The Industry Canada definition uses seven of the current SIC codes. Many reports reviewed for this study often ignore the sector by looking at only manufactured products, or consider a much broader definition of the sector than the Industry Canada definition. Thus, it is very difficult to extract and compare information about the sector. The charts and information in this report use the Industry Canada definition wherever possible, and the authors believe that the numbers contained in this report reflect a reasonable conservative representation of the industry.

Industry Canada's definition of SICs that comprise the ICT Sector:

Manufactured Products:

<b>SIC</b>	<b>Description</b>
3341	Consumer Electronics
335	Communications and Other Electronic Components
336	Computer Equipment
3911 & 3912	Instrumentation

Services:

<b>SIC</b>	<b>Description</b>
772	Software and Related Services
482	Telecommunication Carriers
481	Broadcasting

New NAICSs relevant to the ICT Sector which did not exist in the 1980 SIC:

<b>NAIC</b>	<b>Description</b>	<b>Number of Sub-Industries</b>
51	Information and Cultural Industries	30
54	Professional, Scientific, and Technical Services	40
71	Arts, Entertainment, and Recreation	31



## Appendix VI Terms of Reference, Members, and Stakeholders

The Alberta Science and Research Authority provided the following terms of reference to the Task Force:

Prepare a report, which will go from ASRA to the Minister Responsible for Science, Research and Information Technology, recommending a strategy and action plan for the Government of Alberta, the information technology and telecommunications industry and others, to facilitate and promote the maximum possible development of the information technologies/telecommunications sector in Alberta.

### Members of the Task Force

Mr. John Brick, Account Vice President, Alberta, NORTEL Networks (formerly Northern Telecom),  
Task Force Chairman

Dr. Ruth Collins-Nakai, Professor of Medicine, University of Alberta

\*Mr. William D. Croft, President, Calgary Research & Development Authority, Task Force Vice Chairman

Dr. Robert Fessenden, President, Alberta Science and Research Authority

Mr. Brian Gibson, Vice President, Business Services, TELUS Communications (Edmonton) Inc.

Mr. Roger Jackson, Deputy Minister, Alberta Economic Development

\*Mr. Tom Ogaranko, Director, Knowledge Channel Corporation

Mr. Michael Pfeiffer, President, QC Data Ltd.

Mr. Glenn Rainbird, President and CEO, TRLabs

Mr. George Samoil, Chief Information Officer, Government of Alberta

\*Ms. Lynn Sutherland, Senior Advisor, Information and Communications Technology, ASRA; former Manager, Advanced Computing, Alberta Research Council

Dr. Mo Watanabe, Chair, CANARIE

\* Members of the Task Force Secretariat

### Alberta Stakeholders Interviewed

The following individuals—selected to be representative of the many applications of ICT, companies large and small, and the two major cities—were interviewed, or responded to a letter with questionnaire from Dr. Lorne Taylor, Minister of Science Research and Information Technology. The Task Force also established a Website to which interested parties contributed.

Mr. John Abrahamson, Chair, Alberta IT Association, CIPS, IBM Canada Ltd.

Mr. Bruce Alton, President, Blackstone Multimedia Corporation

Dr. Michael Boorman, Dean of Science, University of Calgary

Mr. Kevin Brown, CIO, EPCOR

Dr. Ernie Chang, Vice-President, Axia Multimedia Corporation

- Dr. Terry Church, Team Leader, Food and Rural Development, Alberta Agriculture
- Mr. Bill Clark, Vice President, Edmonton and Northern Alberta, CGI Information Systems and Management Consultants Inc.
- Dr. Ruth Collins-Nakai, Professor of Medicine, University of Alberta
- Mr. George Czisler, Director, Technology Applications, Computing Devices Canada
- Ms. Sara Diamond, Executive Producer Television and New Media, Banff Centre for the Arts
- Mr. Gaylen Duncan, President, Information Technology Association of Canada
- Mr. Ed Engstrom, Director, Information Technology, MetroNet Communications Corporation
- Dr. Marvin Fritzler, Associate Dean Research, Faculty of Medicine, University of Calgary
- Dr. Ronald E. George, Past-President, Perigon Solutions Inc.
- Dr. Trudy Gahlinger, Mount Royal College
- Dr. Brian Gaines, Dean, Faculty of Graduate Studies, University of Calgary
- Mr. Brian Gibson, Vice-President, Business Services, TELUS Communications (Edmonton) Inc.
- Ms. Patricia Glenn, President, Proactive Technology Training
- Dr. Randy Goebel, Professor and Associate Chair, Department of Computing Science, University of Alberta
- Mr. Ken D. Hewitt, General Manager, WurcNet Inc.
- Mr. Earl Hickock, President, Tecskor Software Inc. and Advantage Energy Corporation
- Mr. David Hudson, Vice President, Business Engineering, CGI Management Consultants Inc.
- Mr. Brian Janzen, Controller, Colt Engineering; former Vice-President, Vendanges Investments Inc.
- Dr. Ron Keast, President and CEO, ACCESS Learning and Skills Television of Alberta Limited
- Dr. Thomas P. Keenan, Dean, Faculty of Continuing Education, University of Calgary
- Ms. Nancy Knowlton, Vice-President, SMART Technologies Inc.
- Mr. Gord Lucas, Project Manager, Wellnet, IBM Canada Ltd.
- Mr. Chris Lumb, President, Alberta Microelectronic Centre
- Mr. Douglas Macleod, Director of Projects, WurcNet
- Mr. David Martin, President, SMART Technologies Inc.
- Mr. John Masters, President, Calgary Research & Development Authority
- Mr. John McAllister, Director, Wellnet, Alberta Health
- Ms. Mary F. McGuire, President, Bexx Design Inc.
- Dr. Alex McPherson, President and CEO, Biomira Inc.; former Chairman, Technology Committee, Alberta Economic Development Authority
- Mr. Frank Meyer, President, Computer Modelling Group

Mr. J. P. (Joe) Moreau, General Manager Southern Alberta, IBM Canada Ltd.

Dr. Randy Morse, President, Oz New Media Inc.

Mr. Roderick G. Munro, President, Vendanges Investments Inc.

Dr. Ruben F. W. Nelson, President, Square One Management Ltd.

Dr. Tom Noseworthy, Chair, Senior Reference Committee, Alberta Wellnet

Mr. Michael Pfeiffer, President, QC Data Ltd.

Mr. Art Price, President, Axia Multimedia Corporation

Mr. Glenn Rainbird, President and CEO, TRLabs

Mr. Pier Rubesa, President, GENIX Corporation; former President, Starcard Technologies International Inc.

Mr. George Samoil, Chief Information Officer, Government of Alberta

Mr. Peter L. Senchuk, President, Future One; former Commissioner, Canadian Radio & Telecommunications Commission

Mr. Jim Shaw Jr., President, Shaw Communications Inc.

Dr. Sam Shaw, President, NAIT

Mr. Don Simpson, President, Geo-X Systems Ltd.

Mr. John Sokolowski, General Manager Services, IBM Canada Ltd.

Dr. Paul Sorenson, Chairman, Department of Computing Science, University of Alberta

Mr. George Squires, Vice-President, TRLabs

Mr. Hugh Stanfield, President, Pulsonic Geophysical Ltd.

Mr. D.R. Tindall, Director, Engineering, Computing Devices Canada

Mr. Gordon R. Tweddell, Director, Business Planning, TELUS Communications (Calgary) Inc.

Dr. Brian Unger, President, WurcNet

Mr. Douglas Walker, President, SiliconGraphics Canada Ltd.

Dr. M. Watanabe, Chairman, CANARIE; Professor Emeritus, Faculty of Medicine, University of Calgary

Mr. John Webb, President, Cell-Loc Inc.

Mr. David J. Wharry, Director-Market Development, SiliconGraphics Canada Ltd.

Mr. J. N. (Jim) Williams, Chief Financial Officer, StarGenix Corporation

Dr. Hatim Zaghloul, President, Wi-Lan Inc.

Dr. Sheldon Zelitt, Chairman and Chief Scientist, VisualABS







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